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Multi-Frequency Resonant Antenna

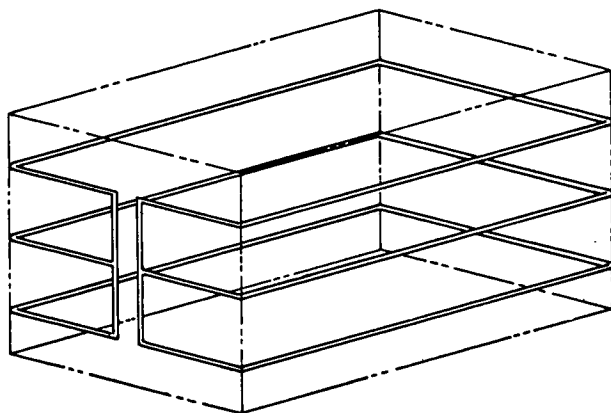


Figure 1. Antenna Configuration

The problem:

Remote monitoring of biological parameters is accomplished by a frequency modulation, closed-loop telemetry system. The system requires an antenna which can transmit and/or receive multiple frequency signals. The antenna must also provide a near-field radiator which has a constant current distribution across its radiating elements for each of the resonant frequencies.

The solution:

Rather than use multiple antennas, a single multi-frequency resonant antenna was designed to be simultaneously resonant at 8.75 MHz, 11.825 MHz, and 20.562 MHz. The design approach was verified by the construction and test of a three-turn, near-field radiator.

How it's done:

Each of the three turns of the antenna configuration shown in Figure 1 was first treated separately. The radiator elements were broken into segments (each of which was small compared with wavelength) to

insure that the current distribution was approximately uniform over the segments of the antenna and to minimize the voltage loss across compensating networks. Starting from the end of the antenna opposite the terminals of the device, the impedances at the frequencies of the desired resonances were calculated with the aid of transmission line equations for the segments of the antenna. The impedances of series compensating networks, connected between the segments of the antenna, were chosen to compensate for the reactance buildup due to the segments themselves. If an antenna were to be fabricated with symmetrical segments, it would be near resonance at each of the frequencies of interest. Lumped-constant Foster reactance networks were feasible for the compensating networks at the three relatively low frequencies of the single application. The three turns of the antenna were designed as noncoupled elements. Upon fabrication, the individual turns were checked for the required resonances using an impedance bridge and interpolation techniques. It was found necessary to trim the Foster networks to achieve the exact resonances required and to provide uniform current distribution along the radiating elements of the antenna. Trimming was achieved by tuning slugs attached to the reactance coils and by the addition of small capacitors. Figure 2 shows an example design for one of the three turns.

When the three turns were connected in parallel, further compensation was needed to take into account cross coupling between turns. This was accomplished using measurements based on linear coupled circuit theory. Networks were added near the terminals of each turn of the antenna which exactly cancelled the mutual impedance of the other two turns, thereby maintaining resonance as required in each and all of the three turns of the antenna.

(continued overleaf)

The following documentation may be obtained from:

Reference: NASA-CR-82795 (N67-19417),
Research on Microminature Passive Tele-
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